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TECHNOLOGY

Scientists Start Testing Ways To Expand Photons' Potential

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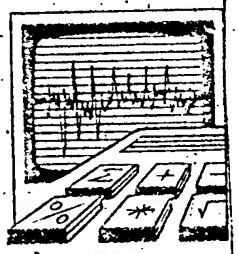
THE LIGHT THAT ALLOWS YOU to read these words is a broad river of particles known as photons. These tiny bundles of radiant energy, smaller than atoms, are brothers of the more familiar electrons whose movement appears in the everyday world as electricity. But the photon doesn't have the cloud of electric charge that surrounds the electron, so photons can move much closer to each other than electrons can without interference.

That ability is one reason why optical fibers, which carry information in beams of light, are starting to supplant the telephone cables that use electricity. They convey more information in the same space. It also suggests that photons might be better at some of the important jobs—computing, switching, signal processing—now done electronically.



Across the country, a small but growing number of scientists are beginning to develop such photonic circuits and optical information processors. Their technology is embryonic, and no one expects it ever to take the place of electronics in most applications. But experts believe that over the next several years, the new optical methods probably will reduce the cost of telephone calls and help improve the sense of vision that industrial machinery is beginning to acquire.

MUCH OF THE RESEARCH—and the only practical applications yet—involves devices that hardly seem like computers at all. They employ lenses, prisms, mirrors and beams of light, and operate, as early computers did, in an analog rather than a digital manner; their answers are the result of measuring rather than counting and arithmetic.

Through the phenomenon of interference, in which the peaks and valleys of one light wave cancel the valleys and peaks of another, these devices compare two images and produce dots of light whose positions depend on the similarities between the images. Digital computers match images by scanning each one dot at a time, and comparing dot after dot. The process can take several minutes for even the fastest digital machine. But the optical computers act on every dot in both images at once so that comparisons are made at the speed of light and computing time is essentially zero.

For military use, these very fast optical computers are being developed to help missiles and bombs recognize targets. In the commercial world, they are beginning to appear on automated assembly lines. For example, Recognition Systems Inc. has coupled optical processors to digital computers to create equipment that can inspect the points of hypodermic needles 10 times faster than humans, or sort cotton by color or separate shell fragments from walnut meat.

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